VEGETATION AREAS OF TEXAS: CONCEPT AND COMMENTARY

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ABSTRACT

Vegetational areas of Texas are based upon a long history of maps developed from the concepts of life forms (physiognomy and structure) and taxa (floristic composition). The number of plant community types in Texas is dependent upon the classification system used and refinements continue. Important results include identification of vegetation types as well as designation of those types that are both threatened and in need of protection. Although boundaries of vegetational areas are difficult to assess, their plant communities are recognizable; thus, the concept of vegetational areas is especially beneficial in floral and faunal conservation and management.

RESUMEN

Las áreas de vegetación de Texas están basadas en una larga historia de mapas desarrollados a partir de conceptos de formas biológicas (fisonomía y estructura) y taxa (composición florística). El número de tipos comunidades vegetales de Texas depende del sistema de clasificación usado y los refinamientos realizados. Los resultados importantes incluyen identificación de los tipos de vegetación así como la designación de aquellos tipos que están amenazados y necesitan protección. Aunque los límites de las áreas de vegetación son difíciles de establecer, sus comunidades vegetales son reconocibles; así, el concepto de áreas de vegetación es especialmente beneficioso en la conservación y manejo de flora y fauna.

INTRODUCTION

MacRoberts and MacRoberts (2008) analyzed the vegetational species richness of Texas. They found that plant species richness does not correlate well with primary productivity or size of currently recognized vegetational areas, i.e., the majority of species are not confined within regional areas. They suggest that the traditional vegetational areas of Texas should be reassessed to provide a simpler vegetational map more reflective of current species distributional information. Therefore, I believe it is important to examine the vegetational area concept; to provide some commentary about the ecological processes that produce these areas; and, to discuss their relevance to conservation and management.

VEGETATIONAL AREAS VS. FLORISTIC AREAS

Landscapes exhibit mosaics of vegetational patterns that relate to life forms (physiognomy and structure) such as trees vs. grasses and taxa (floristic composition, i.e., species pattern), e.g., see Oosting (1956); Dansereau (1957); Küchler (1964); Daubenmire (1968); Shimwell (1971). These patterns are plant communities composed of a limited number of life forms and taxa, some of which are more prominent than others, thus, are recognizable. The presence and proportion of life forms and taxa give a given plant community its recognizable characteristics. Only one life form is usually used to characterize a vegetational unit; but, in some cases different life forms may intersperse such as in a savannah (trees and shrubs dominate in some areas, grasses in others). Changes in floristic composition can be used to subdivide a vegetational area. However, no vegetational scheme of delineation or categorization is universally accepted; thus, vegetational maps based on life forms and taxa are subject to continual interpretation revision, and application (e.g., Gould 1962; Correll & Johnston 1970; McMahan et al. 1984; Diamond et al. 1987; Edwards et al. 1989; Hatch et al. 1990; Bezanson 2000; Diggs & Schultze 2003; Griffith et al. 2004; Telfair 2006). Nevertheless, the concept of vegetational areas is important and necessary for landscape preservation and wildlife habitat conservation and management in Texas (Telfair 1999). See Diggs et al. (2006) for examples of most of these maps in reduced size and color as well as detailed discussion. The Figure 4 map (Telfair's Vegetational Regions of Texas) will require use of a hand lens or magnifying glass to see some county boundaries and to identify small outlier areas of vegetation. However, the map is available online with a zoom feature—http://artemis.austincollege.edu/acad/bio/gdiggs/EastTX/introduction.pdf—page 6 (p. 23 of the pdf introduction).

Vegetational patterns reflect the influences of many geographic as well as climatic factors that have interacted over long periods of geologic time to produce regions and subregions of characteristic vegetation. In contrast, floristic regions largely reflect only the influence of climatic factors, mainly rainfall and temperature (for comparison, see the 2 maps of vegetational and floristic regions, Turner et al. 2003). However, vegetational patterns are also subject to many widespread human-caused influences, especially farming and ranching, water resource development, forestry practices, mineral and energy production, urban/industrial expansion, recreational/leisure developments, transportation facilities, introduced species, and land fragmentation (USFWS 1979; Gunter & Oelschlaeger 1997; Telfair 1999; James 2000).

COMMENTARY

Texas landscape regions and their included plant communities are more diverse than those of any other state. These regions are defined by their prominent vegetation (vegetation areas) or physiographic features (ecological regions). In most regions, there is close correlation between vegetational and ecological areas except where names refer to physical features, e.g., Coastal Sand Plains, Llano Uplift, Rolling Plains, High Plains, Edwards Plateau, and Trans-Pecos Desertic Basin, Plains, and Mountains. However, most subdivisions within these regions are named for the prominent vegetation therein. These regions are a result of millions of years of the interaction of geological, climatic, and other geographic influences. They form a complex mosaic of odd shapes, sizes, and patterns some of which are interwoven. However, their natural history can be interpreted ecologically.

Spearing (1991) provided maps and analysis of ecological processes that formed the physiography of Texas. Seven basic geologic processes are involved: 1) mountain building and erosion, 2) basin formation and filling, 3) uplifts, 4) volcanism, 5) wind erosion, 6) marine influences, and 7) stream entrenchment. In combination with these geological processes, climatic processes (annual and seasonal rainfall and temperature patterns) produced regional zones that influenced the development of soil associations which, in turn, influenced the types and patterns of vegetation that developed co-regionally (Griffiths & Orton 1968; Godfrey et al. 1973).

The combination of rainfall and temperature patterns, in relation to the influence of topography, forms regional climatic zones of arid to humid, tropical to temperate. Thus, in general, there are 3 major climatic zones in Texas with distinct vegetation: 1) the eastern 10% (humid, forested), central 80% (semi-humid to semi-arid (primarily grasslands and savannahs), and 3) western 10% arid (desert vegetation).The major environmental conditions of these zones are:

Forest.—Major influential environmental factors are precipitation and soil nutrients; fire in some areas (e.g., longleaf pine and post oak savannah communities). Most nutrients are bound in woody tissues for many years, thus, sandy forest soils are especially nutrient deficient.

Grassland.—Major influential environmental factors are drying winds, droughts, irregular rainfall, and lightning-caused fires. Nutrients recycle annually between plants and soils, much being stored in the soil. In relation to rainfall belts, grasses vary from short to tall along a gradient from west to east.

Desert.—Major influential environmental factors are water shortage and heat/cold stress. When deserts formed, local plants adapted and some immigrated from more southern tropical climates.

Other important regional geographic influences are rivers, elevations, soils, and standing water (Spearing 1991). River drainages allow bottomland forests to extend far westward along riparian corridors into grasslands; some smaller drainages also occur in desert areas. The Texas land surface rises gradually from sea level northwestward to almost 1524 m. Abrupt changes in elevation occur at the Balcones and Caprock Escarpments. In the Trans-Pecos Region, mountains rise to heights of 1524–2667 m from valley floors of 914–1219 m elevation. These elevation changes influence regional climates which, in turn, influence the vegetation. Soils are of major influence in the development of growing conditions for vegetation. Worldwide there are 12 soil orders of which 9 occur in Texas. These 9 orders, in Texas, include 73 soil associations, and about 1300 soil series (National Resource Conservation Service 2008). Thus, the great variety of Texas soils reflects the diversity of geologic, climatic, and biologic conditions during which they developed. Also, there is a strong correlation with vegetational patterns. Soil Order name derivatives (Godfrey et al. 1973; Soil Survey Staff 1999) illustrate the basic soil differences and types of vegetation supported.

Alfisols	Leached of aluminum and iron; subsurface clay accumulation; occur in semiarid to moist areas; primarily in forest areas.
Aridisols	Dry; lack of moisture allows accumulation of salts and minerals; deserts.
Entisols	Recent soils of little development in areas of high erosion or deposition rates; occur in dunes, steep slopes, and flood plains; good examples are Monahans and coastal sand dunes and islands.
Histosols*	High fiber tissue content; mostly saturated bogs and marshes.
Inceptisols	Beginning to moderate development; semiarid to humid slopes; depressions, flood plains.
Mollisols	Soft; dark with accumulated organic matter; highly fertile; grasslands.
Spodosols*	Ash-colored, acid, infertile sandy subsoil with accumulation of iron and organic matter; coniferous forests of humid areas.
Vertisols	High in clays; swell when wet; crack when dry; fairly high in natural fertility; grasslands.
Ultisols	Well-developed, maximum leached; pine forests.

*Occur in small areas; usually too small to map.

Surface water can provide many types of small, local, and diverse plant communities within each vegetation region (e.g., swamps, marshes, oxbow lakes, bogs, seeps, playa lakes).

Some vegetational areas are the result of influencing factors that override or dominate other factors. The Post Oak Savannah (or Clay Pan Savannah) occurs in a forest climate, but developed under the influence of an edaphic factor (a shallow nearly impervious clay pan restricts water percolation during dry periods); so, plant diversity is lessened. An unusual exception to the "Clay Pan" soils occurs in Bastrop County—home of the "Lost Pines", where there is a sandy inclusion of moist soils—the Carrizo Sands—which support a unique community of loblolly pines, a western remnant once connected to the now more eastern pine forest. These relict pines have developed an ecotype more drought-tolerant than those to the east. Blackland Prairies occur in a forest climate, but developed under the control of pyric and edaphic factors. The high clay content of this soil causes it to swell during periods of high rainfall and to shrink during periods of drought. The shrinkage opens wide, deep crack that damage tree roots. Also, most grassland plants are fire-adapted; thus, resprout from below-ground root collars rather than the above-ground terminal buds for most forest plants. The forested areas of the East and West Cross Timbers occur in a grassland climate; but, deep, moist, sandy soil belts allow trees to dominate. Coastal region vegetation is highly variable (dunes, marshes, prairies, and forests). It is influenced by many interacting marine influences (e.g., stream erosion, sedimentation, meandering, and delta formation; wave and tidal action; and the influence of hurricane winds and salt spray. Wind erosion produced the Monahans Sands in west Texas, and the Coastal Sand Plains between Corpus Christi and Brownsville in south Texas.

Differential regional blending or transition of environmental factors, the influence of locally controlling factors, and the adaptation of vegetation make difficult delineation of boundaries between regional and subregional areas; and, in some areas, there are inclusions of one area within another (e.g., "islands" within adjacent regions). Nevertheless, regional and subregional distinctions in vegetation are recognizable and mappable.

Physical, floral, and faunal regions of Texas were analyzed in detail by the U.S. Fish and Wildlife Service (1979). This reference is 30 years old, seldom cited, but important. It was prepared as a concept plan to determine unique wildlife ecosystems of Texas and contains detailed maps and extensive regional descriptions of flora and fauna with listings of many representative species. The wildlife section analyzes general zoography, distributional trends, and regional faunas with lists of species of special concern and threatened and endangered species.

CONCLUSIONS

The number of plant community types in Texas is dependent upon the classification system used (Bezanson 2000). However, an important result has been not only the identification of vegetation types; but, those that are both threatened and in need of protection. Thus, although boundaries of vegetational areas are difficult to assess, their plant communities are recognizable; thus, the concept of vegetational areas is especially beneficial in floral and faunal conservation and management. However, as proposed by MacRoberts and MacRoberts (2008), a new vegetational map of Texas based on total flora may provide additional helpful insights for establishing vegetational areas that better interpret the state's phytogeography.

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